Description

Turbine, fixing device for guide blades and working method for removing the guide blades of a turbine

The present invention relates to a turbine according to the preamble of claim 1, a fixing device for guide blades of a turbine according to the preamble of claim 9 and a method for removing the guide blades of a turbine according to the preamble of claim 11.

DE 606 029 discloses the production of a guide-blade ring for steam or gas turbines in which bands or strips are placed around two rollers, so that they assume an annular form. The bands or strips are provided with cutouts, into which the blades are inserted. After all the blades have been inserted, the guide-blade ring is welded. In the process, the blades are first of all fixed to the strips (which form the platforms) by means of spot welds and the welding is then continued as deposition welding on the outside of the bands or strip until a sufficiently thick layer of the welding metal is formed, which can then be partly turned down. To this end, the welded guide-blade ring is chucked in place in a lathe and machined until a coaxially encircling extension of dovetailed cross section remains. The encircling extension, i.e. the one-piece guide-blade ring, is then fixed in a circular holder which can be clamped by screws or rivets.

DE 195 46 722 A1 discloses a guide-blade carrier for a gas turbine. On its inside facing the hot-gas duct, the guide-blade carrier has a plurality of slots which are arranged one behind the other in its axial longitudinal extent and which run in an annular manner in the circumferential direction and are at the same time provided with a respective undercut. The slots serve to accommodate guide-blade roots of a guide blade. To this end,

the root of a guide blade is pushed in the circumferential direction into the slot running in an annular manner.

For repair, inspection and/or maintenance work on the guide blades, they must be removed from the gas turbine. To this end, the gas turbine is opened, so that the guide-blade carrier is accessible and the guide blades can be pushed out of the slot. The opening of the gas turbine is time-consuming and requires a corresponding long shutdown of the gas turbine.

The object of the present invention is to reduce the downtimes of the turbine during repair, inspection and/or maintenance work.

The object is achieved by the features and measures of claim 1. Further advantageous configurations of the invention are given in the subclaims.

The solution according to the invention provides for the guide-blade root and/or the guide-blade tip of each guide blade to be capable of being secured by means of a manually releasable clamping device accessible from the combustion chamber. The downtimes of the gas turbine can be beneficially reduced by virtue of the fact that the guide blade to be exchanged can be removed through the accessible combustion chamber. To this end, at least one clamping device securing the guide blade can be reached from the combustion chamber. The one clamping device securing the guide-blade root is provided on the inner casing and/or the other clamping device secures the guide-blade tip and is arranged on the fixing ring. After the release of the clamping device(s), therefore, each guide blade can thus be removed from the combustion chamber without the inner casing of the turbine having to be opened.

In an advantageous development, provision is made for the clamping device to be capable of being secured to the inner casing or to the fixing housing, respectively, and for it to fasten the guide-blade root or the guide-blade tip, respectively, in an operating position by means of a tie rod running in the axial direction. During the fixing of the guide blade, the inner casing or the fixing ring, respectively, serves as an abutment for the clamping device. The tie rod fastens the clamping device first on the inner casing or on the fixing ring, respectively, and then on the guide blade.

In a further configuration, to remove the guide blade through the combustion chamber, at least that part of the clamping device which faces the combustion chamber can be removed from the clearance profile of the guide blade after the release of the tie rod. The clearance profile of the guide blade is described by the contour of the guide blade as viewed from the combustion chamber in the axial direction. The guide blade is exposed after removal of the clamping device from the clearance profile.

A working method for removing the guide blades of a turbine is described by the features of claim 9.

The invention provides for a guide blade of the first guide-blade row as viewed in the direction of flow of the working medium to be removed manually through the combustion chamber by the sequence of the following steps:

Patent claims

1. A turbine (1) comprising a rotor (3) extending in the axial direction and an accessible combustion chamber (6) which communicates with an annular hot-gas duct (18) in which a multiplicity of guide blades (12) are arranged in such a way as to form a guide-blade row (13), each guide blade (12) having a guide-blade root (21) fixed to the inner casing (20) and a guide-blade tip (22) which is opposite the guide-blade root (21), faces the rotor (3) and is fixed to a fixing ring (24), enclosing the rotor (3), of the turbine (1), characterized in that the guide-blade root (21) and/or the guide-blade tip (22) of each guide blade (21) can be secured by means of a manually releasable clamping device (25, 35) accessible from the combustion chamber.

2. The turbine (1) as claimed in claim 1, characterized in that the clamping device (25, 35) can be secured to the inner casing (20) or to the fixing ring (24), respectively, and fastens the guide-blade root (21) or the guide-blade tip (22), respectively, in an operating position by means of a tie rod (28, 38) running in the axial direction.

3. The turbine (1) as claimed in claim 1 or 2, characterized in that, to remove the guide blade (12) through the combustion chamber (6), at least that part of the clamping device (25, 35) which faces the combustion chamber (6) can be removed from the clearance profile of the guide blade (12) after the release of the tie rod (28, 38).

4. The turbine (1) as claimed in one of the preceding claims, characterized in that,

to remove the guide blade (12), the clamping device (25, 35) can be fixed in a parking position exposing the guide-blade root (21) or guide-blade tip (22), respectively.

5. The turbine (1) as claimed in one of the preceding claims, characterized in that the clamping device (25, 35) comprises two radially extending retaining stops (26, 27, 36, 37) which can be fastened by means of the tie rod (28, 38).

6. The turbine (1) as claimed in one of the preceding claims, characterized in that the guide blade (12) is arranged in the first guide-blade row (13) as viewed in the direction of flow of a working medium (11).

7. The turbine (1) as claimed in one of the preceding claims, characterized in that the clamping device (25) can be removed from the inner casing (20) after removal of the guide blade (12).

8. The turbine (1) as claimed in one of the preceding claims, characterized in that a guide ring arranged downstream in the direction of flow of a working medium (11) is manually accessible after removal of the clamping device (25) fixed to the inner casing (20).

9. A method of removing a guide blade (12) from a turbine (1) comprising a rotor (3) extending in the axial direction and an accessible combustion chamber (6) which communicates with an annular hot-gas duct (18) in which a multiplicity of guide blades (12) are arranged in such a way as to form a guide-blade row (13), each guide blade (12) having a guide-blade root (21) fixed to the inner casing (20) and a

guide-blade tip (22) which is opposite the guide-blade root (21), faces the rotor (3) and is fixed to a fixing ring (24), enclosing the rotor (3), of the turbine (1) as claimed in one or more of the preceding claims, characterized in that the guide blade (12) of the first guide-blade row (13) as viewed in the direction of flow of the working medium (25, 35) is removed manually through the combustion chamber (6) by the sequence of the following steps:

a. the clamping device (25) arranged on the inner casing is released, then displaced into a parking position exposing the guide-blade root (21) and fixed there again,
b. the other clamping device (35) arranged at the inner fixing ring (24) is released, so that the guide-blade tip (22) is exposed,
c. the guide blade (12) is displaced axially against the direction of flow of the working medium and is then tilted about the guide-blade tip (22),
d. so that the guide blade (12) is free by being moved radially outward.